Air Toxics Summary for 2022

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State of Oregon
DEQ Department of Environmental Quality

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3. Executive Summary

The purpose of the Oregon Department of Environmental Quality's air toxics monitoring program is to measure air toxics in urban and rural areas around the state where people live, work, and play. This information provides a snapshot of air quality in several communities across Oregon and helps DEQ make informed decisions regarding how to best regulate air toxics in the future. This report summarizes the results of the data collected in 2022 and gives insight into the potential impacts to the environment and human health.

DEQ monitored up to 106 different air toxics at each of the 10 monitoring locations in 2022. Compared to other air toxics monitoring sites in the U.S., Oregon sites have lower levels of air toxics for most monitored toxics. An exception to this is formaldehyde, where levels are above the national average. Still, this risk is considered low, even at the highest levels found in the state. DEQ has established long-term monitoring sites in NE Portland and La Grande. Since 2004, air toxics have decreased significantly at the NE Portland site, especially for cadmium. In La Grande, air toxics levels have not changed significantly.

DEQ's network of air toxics monitors have continued to evolve and expand over the years based on updated federal guidance and available resources. DEQ's air toxics monitoring network has evolved to be one of the most extensive of any state in the United States. As of 2024, DEQ operates 11 air toxics monitoring stations and hopes to expand further. The air toxics monitoring program, involving many critical components, continues to strive to inform communities in Oregon about air toxics in the air they breathe.

DEQ has multiple air quality monitoring networks in addition to the air toxics network. Many people may be familiar with the air quality monitors that show up on the OregonAir app or AirNow.gov. These resources have become increasingly popular for understanding air quality during wildfire season. These monitors report the air quality index, or AQI, which is a measurement of how much particulate matter pollution is in the air. This is different than monitors for air toxics, which measure many more types of pollution, and do not show up on the AQI websites.

4. Scope of Report

This report includes information about DEQ's air toxics monitoring program and results of samples collected in 2022. The goal of this report is to provide information about how data is generated in the program, technical details about sampling and analytical methods, and give insight into results from data collected. The air toxics data DEQ collects and analyze is summarized in this report and is intended to inform not only air quality programs at DEQ but also other agencies programs around the state. It is also intended to inform anyone in Oregon who is interested in learning more about the air they breathe. In addition to analyses of collected air toxics samples, the report also includes information from Oregon Health Authority about health impacts of air toxics exposure.

5. Introduction to Air Toxics

The Oregon Department of Environmental Quality monitors ambient air pollutants throughout the state as required by federal law in the Clean Air Act. These air pollutants are classified into two categories, referred to as criteria air pollutants and hazardous air pollutants, also known as air toxics. Air toxics have been known to cause negative health effects due to long-term (chronic) or short-term (acute) exposure. This report summarizes air toxics data that was collected in 2022 at 10 monitoring locations to provide information to the public and inform strategies to protect public health.

5.1 What are air toxics?

This report uses the terms “air toxics”, “toxic air contaminants” and “hazardous air pollutants” interchangeably. These terms refer to a diverse group of chemicals present in our air which, in high enough amounts, are known or suspected to increase risk of cancer or other serious health effects, or adversely affect environmental quality. Most air toxics come from human-made sources such as vehicles (cars, buses, ships, planes), industrial facilities (factories, refineries, power plants), as well as small businesses and residences, including residential wood burning. There are also some notable natural sources such as forest fires and volcanic eruptions which also release air toxics and can affect air quality at local and regional scales. Some air toxics are carried into Oregon from sources outside our state. Common air toxics include benzene, naphthalene, formaldehyde, and metals such as nickel and lead.

5.2 Which air toxics does DEQ measure?

Section 112 of the federal Clean Air Act defines a list of 188 HAPs for which U.S. Environmental Protection Agency is required to regulate emissions to protect public health. Since measuring all 188 HAPs at every sampling location is not feasible, EPA developed a list of 60 HAPs that are measured as part of its National Air Toxics Trends Station, or NATTS Program. EPA selected these pollutants because they have the greatest impact on public health and the environment in urban areas, and because cost-efficient measurement methods exist. As part of DEQ’s air toxics monitoring program, a total of 107 air toxics are measured at each monitoring site, which include all 60 priority HAPs in the NATTS program. In addition to EPA requirements for air toxics monitoring, Environmental Quality Commission, DEQ’s governing body, adopted rules in late 2018 to create the Cleaner Air Oregon Program. This program sets health risk limits on HAPs that industrial facilities emit so that neighbors and vulnerable people are protected from potentially harmful exposures. A list of air toxics can be found at the EPA and Cleaner Air Oregon program websites.

6. Air Toxics Monitoring Program

The purpose of the Air Toxics Monitoring Program is to measure air toxics around the state where people live, work, and play. This information gives DEQ programs and other state and local agencies information to inform decisions about how to best regulate air toxics and mitigate exposure to their harmful effects. It also helps communities understand the quality of the air they breathe. As of 2024, DEQ operates 11 air toxics monitoring stations in Oregon as part of three main networks, each network with its own goals. These networks are the National Air Toxics Trends Stations (NATTS), Oregon trend sites, and rotating annual sites. In this report the terms “station” or “site” are used interchangeably and serve the same purpose.

6.1 EPA National Air Toxics Trends Stations Program

DEQ operates two stations primarily funded by EPA as part of its NATTS program. Data from Oregon’s urban (Portland) and rural (La Grande) monitoring sites are combined by EPA with data from other NATTS sites across the country and used to assess national-level air toxics trends detailed in the EPA’s

National Air Toxics Assessment. DEQ uses data from these two sites to track key performance measures in relation to air toxics. Both sites in this network adhere to consistent sampling methods, analytical procedures, quality assurance, and the sampling schedule described by the NATTS program. Additionally, DEQ has adopted the NATTS program guidelines and procedures for operating all DEQ air toxics monitoring stations and laboratory analyses of samples.

6.2 Oregon Air Toxics Trends Sites

In 2017, the Oregon Legislature approved funding for DEQ to install and operate six new air toxics trend sites. Stations designated as “trend sites” are long-term monitoring sites located in cities with large populations or where DEQ identified risks of air toxics. The goal for the trend sites is to measure changes in air toxics over time in representative areas of the state. Since 2018, trend sites have been established in Eugene, Medford, Bend, and three locations in the Portland Metro area: Hillsboro, Tualatin, and the NE Portland Cully neighborhood. More information about location selection can be found at DEQ’s website.

6.3 Rotating Annual Sites

Air toxics monitoring sites require significant resources to install, operate, and maintain. It is not feasible for DEQ to measure air toxics at every desired location simultaneously. In efforts to monitor and identify air quality issues throughout the state, DEQ conducts monitoring at sites for one year and then relocates sampling equipment to the next “annual site” on a prioritized list to conduct monitoring. The locations of rotating annual sites are prioritized based on six factors: 1) known or potential sources of pollution, 2) number of pollutants of concern, 3) relative toxicity, 4) lack of air toxics data, 5) community and demographic factors such as proximity of residential neighborhoods to industrial sources, and 6) to address local concerns.

Two annual rotating sites are included in this report: the Eugene Amazon Park site, and the Corvallis Park & Goodnight site. The Corvallis Park & Goodnight site has a unique dataset because sampling began on April 22, 2021, sampling was paused several times and concluded in July 2023. The complete dataset for Corvallis is analyzed in this report.

6.4 Key Performance Measures

Oregon DEQ sets targets to reduce air toxics in ambient air. The data and statistical analyses from monitoring sites informs progress toward these targets. As one of DEQ’s key performance measures (KPM), DEQ selected five air toxics – benzene, acetaldehyde, formaldehyde, arsenic, and cadmium – to track over the years. These air toxics were selected because there are representative of other air toxics, and they are commonly found in the environment. Oregon DEQ’s goal was to reduce levels of each pollutant to be equal to the ambient benchmark concentration (ABC) by 2020. The ABCs are health-protective air concentrations that would not be expected to harm health even in sensitive populations like children, the elderly, or people with health conditions and are described in more detail in chapter 8. DEQ did not reach its target by 2020, and we continue to work towards reducing air toxics concentrations. The air toxics monitoring data and reports continues to inform air quality programs in their pursuit of this goal.

7. Field and Laboratory Methods

7.1 Air Toxics Parameters

The goal for each site is to measure 107 air toxics. Several of these air toxics are measured in addition to the 60 priority HAPs listed in the NATTS program or listed in the risk assessments for the CAO program. These additional air toxics are still measured because the field and analytical methods used to analyze results can include these at no additional cost. DEQ classifies these pollutants into five groups based on similar sampling and analytical method: heavy metals, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), carbonyls, and hexavalent chromium (Cr^{6+}). Wind speed and direction are also measured at or near each site to inform pollutant dispersion. Tables 1-4 list the air toxics analytes[1] that are measured by the DEQ laboratory. Air toxics are listed according to the analyte category and include the Chemical Abstracts Service registry number (CASRN).

Table 1: Metal Analytes

Metals	
CASRN	***Analyte***
7440-36-0	Antimony, Total
7440-38-2	Arsenic, Total
7440-41-7	Beryllium, Total
7440-43-9	Cadmium, Total
7440-47-3	Chromium, Total
7440-48-4	Cobalt, Total
18540-29-9	Hexavalent Chromium (Cr^{6+})
7439-92-1	Lead, Total
7439-96-5	Manganese, Total
7440-02-0	Nickel, Total
7782-49-2	Selenium, Total

Table 2: Carbonyl Analytes

Carbonyls	
CASRN	***Analyte***
5779-94-2	2,5-Dimethylbenzaldehyde
78-93-3	2-Butanone (MEK)
75-07-0	Acetaldehyde
67-64-1	Acetone
100-52-7	Benzaldehyde
123-72-8	Butyraldehyde

[1] *A substance whose chemical constituents are being identified and measured.*

123-73-9	Crotonaldehyde
50-00-0	Formaldehyde
66-25-1	Hexaldehyde
590-86-3	Isovaleraldehyde
620-23-5	m-Tolualdehyde
529-20-4	o-Tolualdehyde
123-38-6	Propionaldehyde
104-87-0	p-Tolualdehyde
110-62-3	Valeraldehyde

Table 3: Polycyclic Aromatic Hydrocarbon (PAH) Analytes

PAHs			
CASRN	***Analyte***	***CASRN***	***Analyte***
83-32-9	Acenaphthene	53-70-3	Dibenzo(a,h)anthracene
208-96-8	Acenaphthylene	132-64-9	Dibenzofuran
120-12-7	Anthracene	132-65-0	Dibenzothiophene
56-55-3	Benzo(a)anthracene	206-44-0	Fluoranthene
50-32-8	Benzo(a)pyrene	86-73-7	Fluorene
205-99-2	Benzo(b)fluoranthene	193-39-5	Indeno(1,2,3-cd)pyrene
192-97-2	Benzo(e)pyrene	198-55-0	Perylene
191-24-2	Benzo(g,h,i)perylene	85-01-8	Phenanthrene
207-08-9	Benzo(k)fluoranthene	129-00-0	Pyrene
218-01-9	Chrysene	91-20-3	Naphthalene
191-07-1	Coronene		

Table 4: Volatile Organic Compound (VOC) Analytes

VOCs			
CASRN	***Analyte***	***CASRN***	***Analyte***
71-55-6	1,1,1-Trichloroethane	74-83-9	Bromomethane
79-34-5	1,1,2,2-Tetrachloroethane	75-15-0	Carbon disulfide
79-00-5	1,1,2-Trichloroethane	56-23-5	Carbon tetrachloride
75-34-3	1,1-Dichloroethane	108-90-7	Chlorobenzene
75-35-4	1,1-Dichloroethylene	75-00-3	Chloroethane
120-82-1	1,2,4-Trichlorobenzene	67-66-3	Chloroform
95-63-6	1,2,4-Trimethylbenzene	74-87-3	Chloromethane
106-93-4	1,2-Dibromoethane (EDB)	156-59-2	cis-1,2-Dichloroethene
95-50-1	1,2-Dichlorobenzene	10061-01-5	cis-1,3-Dichloropropene
107-06-2	1,2-Dichloroethane (EDC)	110-82-7	Cyclohexane
78-87-5	1,2-Dichloropropane	124-48-1	Dibromochloromethane
95-47-6	1,2-Dimethylbenzene	75-71-8	Dichlorodifluoromethane (Freon 12)
108-67-8	1,3,5-Trimethylbenzene	76-14-2	Dichlorotetrafluoroethane (Freon 114)
106-99-0	1,3-Butadiene	100-41-4	Ethylbenzene
541-73-1	1,3-Dichlorobenzene	87-68-3	Hexachloro-1,3-butadiene
106-46-7	1,4-Dichlorobenzene	67-63-0	Isopropanol
108-38-3	1,4-Dimethylbenzene + 1,3-Dimethylbenzene	1634-04-4	Methyl tert-butyl ether (MTBE)

123-91-1	1,4-Dioxane	75-09-2	Methylene chloride
78-93-3	2-Butanone (MEK)	80-62-6	Methylmethacrylate
126-99-8	2-Chloro-1,3-butadiene	142-82-5	n-Heptane
591-78-6	2-Hexanone	110-54-3	n-Hexane
622-96-8	4-Ethyltoluene	100-42-5	Styrene
108-10-1	4-Methyl-2-pentanone (MIBK)	127-18-4	Tetrachloroethylene
67-64-1	Acetone	109-99-9	Tetrahydrofuran
75-05-8	Acetonitrile	108-88-3	Toluene
107-02-8	Acrolein	156-60-5	trans-1,2-Dichloroethene
107-13-1	Acrylonitrile	10061-02-6	trans-1,3-Dichloropropene
71-43-2	Benzene	79-01-6	Trichloroethylene
100-44-7	Benzyl chloride	75-69-4	Trichlorofluoromethane (Freon 11)
75-27-4	Bromodichloromethane	76-13-1	Trichlotrifluoroethane (Freon 113)
75-25-2	Bromoform	75-01-4	Vinyl chloride

7.2 Field Sampling Schedule

DEQ uses five individual instruments to sample all air toxics. Carbonyls, PAHs, PM_{10}[2] metals, and hexavalent chromium are sampled by drawing air through respective media at a constant flow rate for a duration of 24 hours. For VOCs, these are sampled by drawing air into a collection canister, also at a constant flow rate for 24 hours. Generally, samples are collected every six days according to the NATTS program sampling schedule. In some cases, sampling may deviate from this schedule by collecting samples more frequently, or by running make-up samples for previously incomplete or voided samples.

7.3 Field Sampling and Laboratory Analytical Methods

DEQ staff perform sampling activities in accordance with DEQ's Air Toxics Monitoring Quality Assurance Project Plan and EPA's Technical Assistance Document for the National Air Toxics Trends Station Program (NATTS TAD). Laboratory analyses are performed at the DEQ laboratory following methods outlined in the NATTS TAD. Table 5 lists the sampling media, equipment, and reference method followed for each sample type.

Table 5: Description of the sampling media, equipment, and laboratory analytical reference method used to collect samples and obtain results for each analyte group.

Sample Type	*Sample Media*	*Sample Equipment*	*Laboratory Analytical Reference Method*

[2] *Particulate matter with diameters of 10 micrometers and less.*

PM10 Metals	2-µm Quartz Filter (High-Volume)	Tisch PM10+ High-Volume Air Sampler	EPA Compendium Method IO-3.5
	PTFE Teflon Filter (Low-Volume)	ARA N-FRM Sampler	
Hexavalent Chromium	Bicarbonate-impregnated Ashless Cellulose Filter	BGI PQ200 / ARA N-FRM	Determination of Hexavalent Chromium in Ambient Air Analyzed By Ion Chromatography (IC) (CARB MLD-039)
VOCs	6L Silonite™ Coated Canister	DEQ Laboratory Custom Sampling Timer	EPA Compendium Method TO-15
PAHs	PUF/XAD Filter Assembly	Tisch PUF+ Sampler	ASTM D6209-13
Carbonyls	DNPH-coated Silica Gel Cartridge	DEQ Laboratory Custom Sampler / ARA CARB	EPA Compendium Method TO-11A

7.4 Air Toxics Monitoring Sites

This report summarizes data from 10 air toxics monitoring sites around the state that were sampling in 2022. The four monitoring sites in the Portland metro area are Cully Neighborhood at Helensview School (Cully), Tualatin near Interstate 5 (Tualatin), Hillsboro Hare Field (Hillsboro), and the Portland NATTS site (NE Portland). The sites outside the Portland metro area include Bend, Eugene at Amazon Park (EAP), Eugene at Highway 99 (E99), Medford, Corvallis, and the La Grande NATTS site.

Figure 1: Air toxics monitoring site locations in 2022.

7.4.1 Site Selection Criteria

DEQ selects air toxics monitoring locations based on several criteria and depending on the objectives of the network type. Site specific siting criteria and guidance are provided in the NATTS TAD and DEQ applies this guidance towards all air toxics monitoring stations outside of the NATTS network. More information about how DEQ prioritizes sites for the placement of annual air toxics monitoring sites can be found in the standard operating procedure document “Statewide Prioritization of Air Toxics Monitoring.”

7.4.2 Site List and Descriptions

This section lists the individual sites and provides a general description of its location. Table 6 provides the name of each site, the city its located in, site type, and the current status.

Table 6: List of sites included in this summary report.

Site Name	Location/ City	Site Type	Current Status
Portland Cully Helensview	Portland	Oregon Trend	Active
Portland NATTS	Portland	EPA NATTS	Active
La Grande NATTS	La Grande	EPA NATTS	Active
Medford Welch & Jackson	Medford	Oregon Trend	Active
Eugene Hwy 99	Eugene	Oregon Trend	Active
Eugene Amazon Park	Eugene	Annual Rotating	Moved Location
Bend 8th & Emerson	Bend	Oregon Trend	Active
Tualatin Bradbury Court	Tualatin	Oregon Trend	Active
Hillsboro Hare Field	Hillsboro	Oregon Trend	Active
Corvallis Park & Goodnight	Corvallis	Annual Rotating	Moved Location

Portland Cully Helensview

This site is located at the Helensview school in the northeast Portland Cully neighborhood (Figures 2-3). The site was initially selected as a rotating annual site; however this site now remains as a long-term trend site. Air toxics sampling began in May 2018.

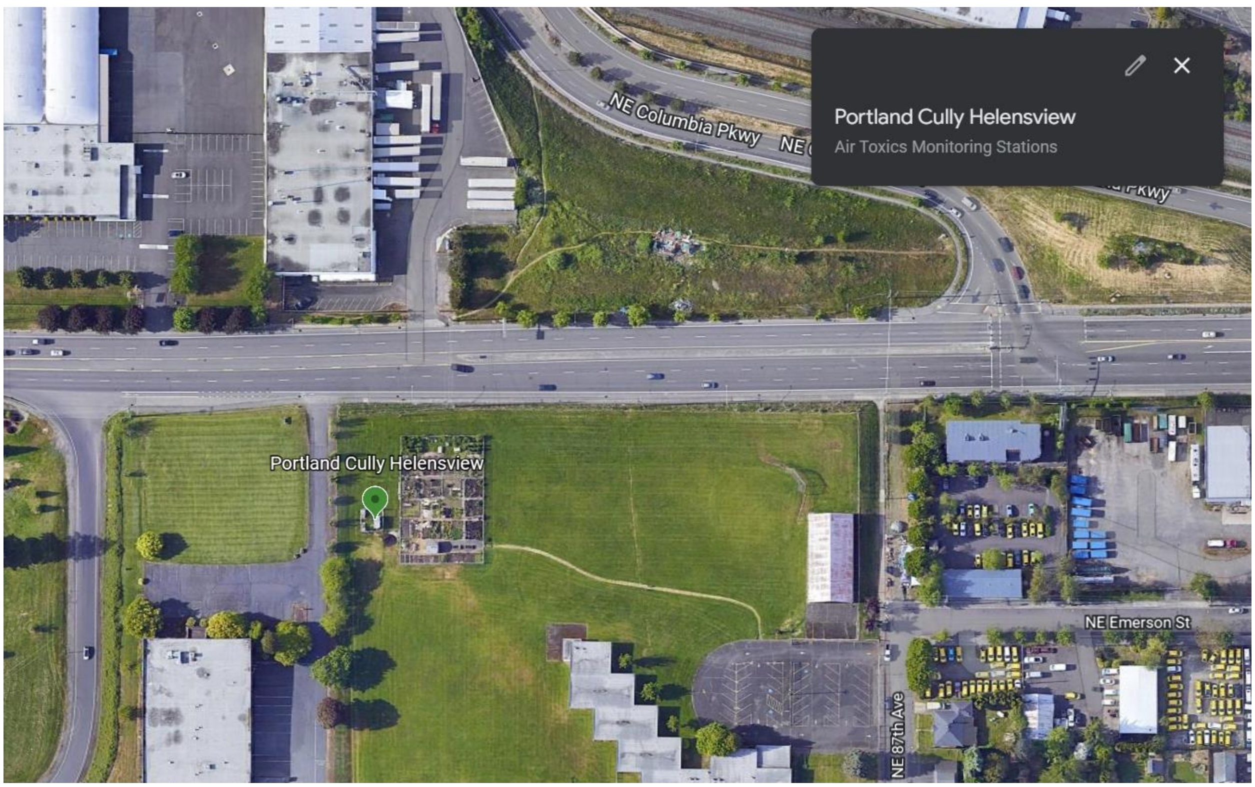

Figure 2: Location of Portland Cully Helensview air toxics monitoring site

Figure 3: Photo of the Portland Cully Helensview air toxics monitoring site

Portland National Air Toxics Trend Station

DEQ has operated an air toxics monitoring site in Portland as part of EPA's NATTS program since 2004 to help the program assess exposures to HAPs in urban areas (Figures 4-5). Prior to its current location, this site was located approximately 0.7 miles to the northeast near the intersection of N. Roselawn Street and N. Vancouver Avenue. Due to the construction impacts of a multi-unit housing complex being built on an adjacent property, the site no longer met the siting criteria of the NATTS program and therefore was moved to its current location at Kairos PDX, near the intersection of N Commercial Ave and N Alberta St. Results from samples collected at the previous location from May 2015 to August 2016 were qualified to note the construction impacts. No samples were collected at this site from August 2016 until March 2017 when sampling began at the current location.

Figure 4: Location of Portland NATTS air toxics monitoring site

Figure 5: Photo of the Portland NATTS air toxics monitoring site

La Grande National Air Toxics Trend Station

Along with the urban NATTS site, DEQ has also operated a rural air toxics monitoring site in La Grande since 2004 as part of EPA's NATTS program in order to compare exposures to HAPs between urban and rural areas across the United States (Figures 6-7). The La Grande site is the most rural air toxics monitoring location presented in this report.

Figure 6: Location of the La Grande NATTS air toxics monitoring site

Figure 7: Photo of the La Grande NATTS air toxics monitoring site

Medford Welch & Jackson

This site is located on Welch St. near its intersection with W Jackson St. in northwest Medford (Figures 8-9). It is in an area next to small businesses and residential homes and is approximately half a mile west of Interstate 5. This site was selected partly due to the topography of the surrounding area. Medford has a unique airshed that reflects smoke impacts from wildfires and thermal inversions. The air toxics data gathered during those events can be useful to understanding their impacts. The Medford site began air toxics sampling in October 2018.

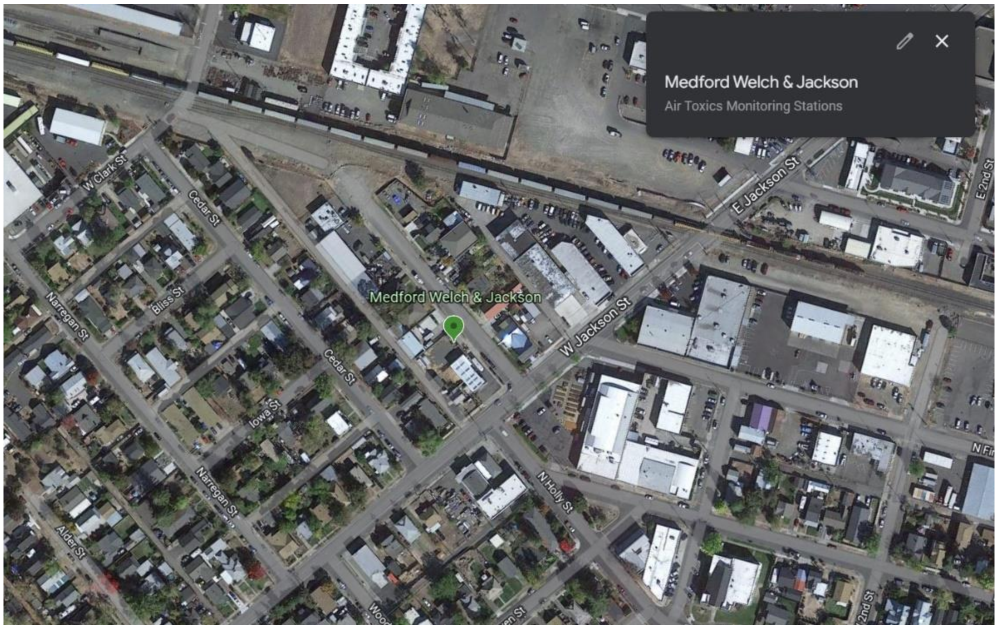

Figure 8: Location of the Medford Welch & Jackson air toxics monitoring site

Figure 9: Photo of the Medford Welch & Jackson air toxics monitoring site

Eugene Highway 99

This site is located near state Highway 99 in Eugene (Figures 10-11). A residential neighborhood lies to the west and Highway 99 to the east. Sampling at the Eugene site began in April 2018 and continues to supplement urban air toxic data.

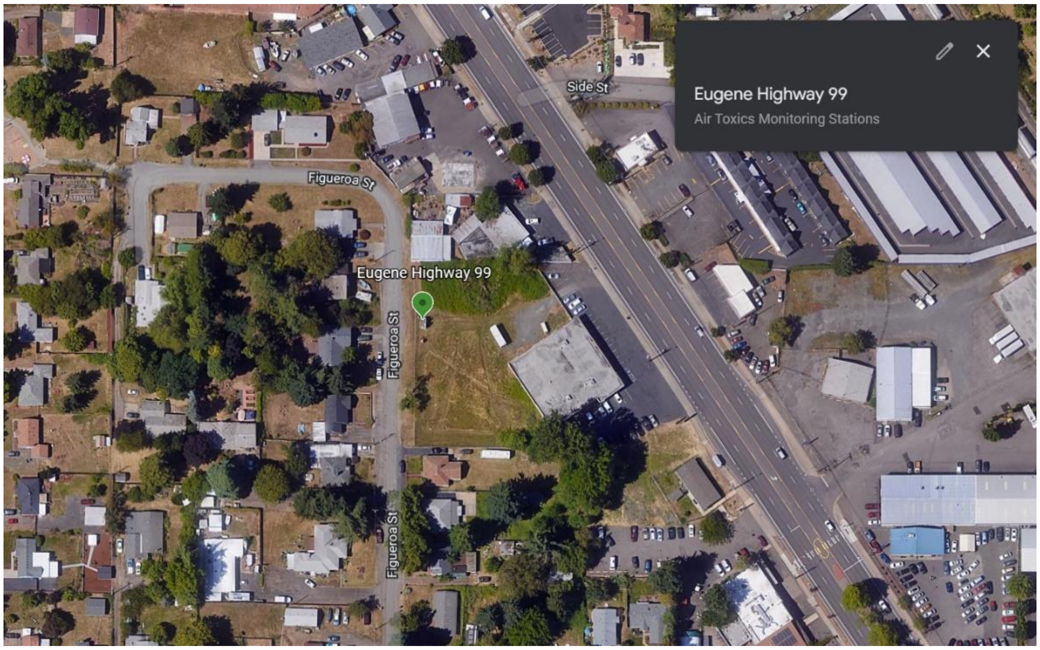

Figure 10: Map of the Eugene Highway 99 Air Toxics Monitoring Site

Figure 11: **Photo of the Eugene 99 Highway Air Toxics Monitoring Site**

Eugene Amazon Park

This site is located inside Amazon Park near E 29th Ave in Eugene (Figures 12-13). It was established as an annual rotating site in 2019. Due to limited resources, the site was not relocated and continued to operate until June 2022. Amazon Park is in south Eugene where there are numerous recreation opportunities, community centers, and natural areas. Air toxics sampling began in April 2018.

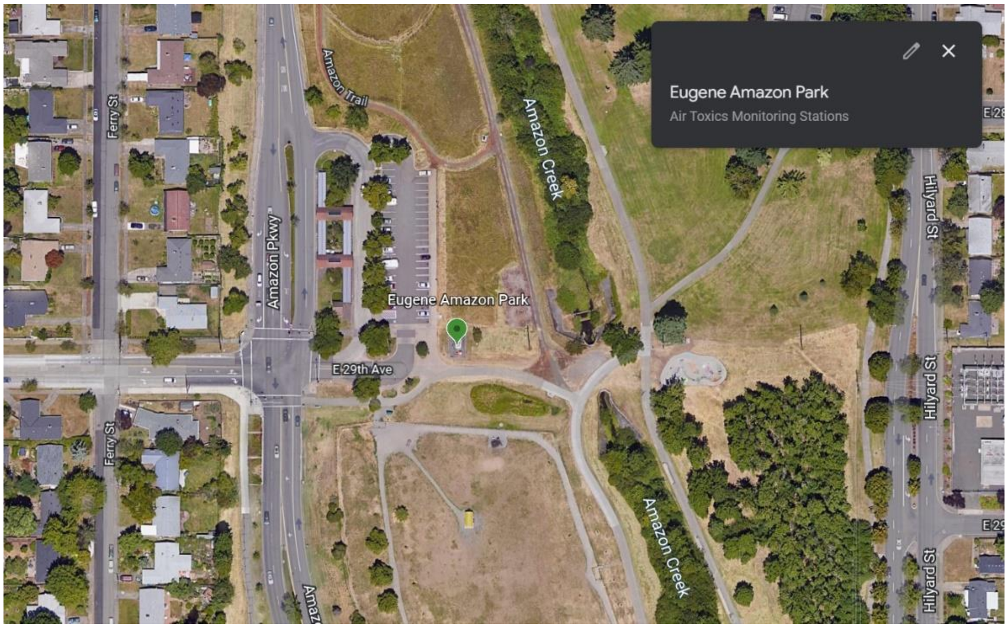

Figure 12: Map of the Eugene Amazon Park Air Toxics Monitoring Site

Figure 13: Photo of the Eugene Amazon Park Air Toxics Monitoring Site

Corvallis Park & Goodnight

The Corvallis Park and Goodnight site began sampling on April 22, 2021. It is located at an EPA funded research station just west of Willamette River near Willamette Park (Figures 14-15). DEQ used the EPA approved low-volume method metals sampling at this site used.

Figure 14: Map image of the Corvallis Park & Goodnight air toxics monitoring site.

Figure 15: Photo of samplers used at the Corvallis Park & Goodnight site.

Bend 8th & Emerson

The Bend site is located at Bend Senior High School, east of State Route 97 and south of State Route 20 (Figure 16-17). This site has the highest elevation of any air toxics monitoring site in this report, at 1114 meters. Air toxics sampling began in August 2020.

Figure 16: Location of the Bend 8th & Emerson Air Toxics Monitoring Site

Figure 17: Photo of the Bend 8th & Emerson Air Toxics Monitoring Site

Tualatin Bradbury Court

Tualatin Bradbury Court is located a few meters from Interstate 5 in Tualatin (Figures 18-19). This site was selected for its proximity to one of the most heavily- trafficked roadways in all of Oregon. Data from this site is useful to understanding the air quality impacts of on-road vehicles. Air toxics sampling began in March 2019.

Figure 18: Location of the Tualatin Bradbury Court Air Toxics Monitoring Site

Figure 19: Photo of Tualatin Bradbury Court Air Toxics Monitoring Site

Hillsboro Hare Field

This site is located at Hare Field in Hillsboro (Figures 20-21). Owned by the Hillsboro School District, Hare Field includes a baseball stadium, a football stadium, practice fields, and track and field equipment.

The venue hosts high school sports, open track meets, and youth sports. Air toxics sampling began in January 2019.

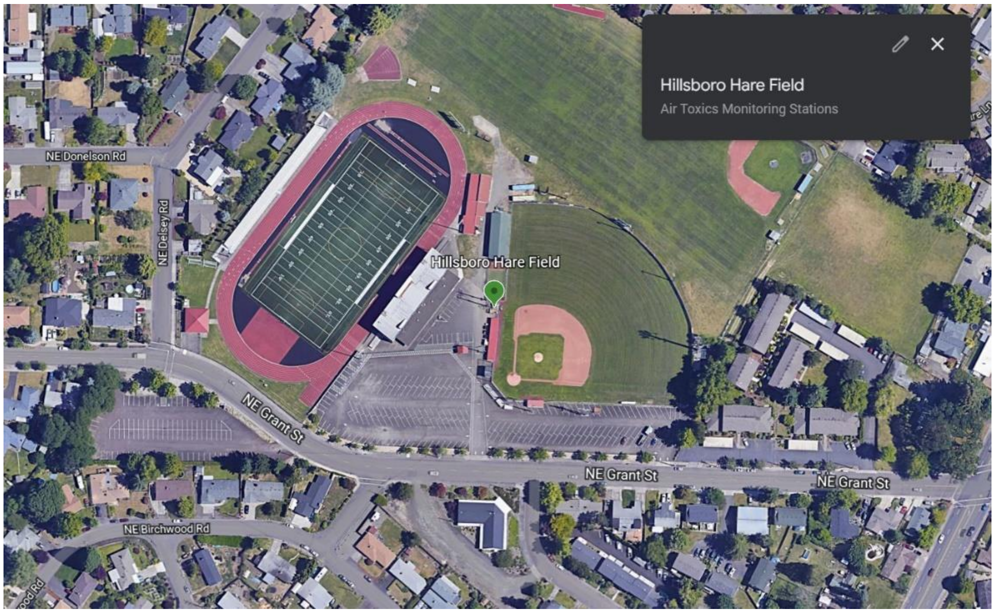

Figure 20: Location of Hillsboro Hare Field Air Toxics Monitoring Site

Figure 21: Photo of Hillsboro Hare Field Air Toxics Monitoring Site

8. Public Health Risks

8.1 Ambient Benchmark Concentrations (ABCs)

Most Oregonians would like to know what the risk to their health is from the air they breathe. Oregon's air toxics ABCs are health-based values that help DEQ identify, evaluate, and address air toxics concerns. Oregon's ABCs are designed to protect the health of the most sensitive individuals in our communities and serve as clean air targets, not regulatory standards. For air toxics with the potential to increase cancer risk, DEQ sets ABCs at levels that would not pose more than one-in-a-million excess lifetime cancer risk if a person breathed air with that level every day for an entire lifetime. For air toxics that have the potential to cause health effects other than cancer, DEQ sets ABCs at concentrations that would not be expected to harm anyone's health even if they breathed that air every day for a lifetime.

The ABCs DEQ developed are based on federal and state authoritative sources, including the U.S. Environmental Protection Agency (EPA), U.S. Agency for Toxic Substances and Disease Registry (ATSDR), and California EPA. DEQ uses values from these agencies because they conduct comprehensive reviews of all available toxicology data on a chemical. Every three years, DEQ reviews all the authoritative sources to see if updates to ABCs are needed based on the current science.

There are different ABCs for the type of health effect (noncancer or cancer) and whether exposure is for a long or short period of time (chronic or acute). Chronic ABCs for cancer and noncancer health effects are intended to be compared against concentrations of pollutants averaged over the course of a year (i.e., the average annual concentration). Table 7 lists the air toxics measured in this report that have ABC values. Not all air toxics have ABCs developed for their individual risks to human health. This chapter uses these ABCs to discuss the public health risks associated with the concentrations of air toxics presented in this report.

Table 7: Air toxics listed with associated ABC values for chronic cancer risk, chronic noncancer risk and acute noncancer risk.

CASRN	Chemical Name	Chronic Cancer ABC (µg/m^3)	Chronic Noncancer ABC (µg/m^3)	Acute Noncancer ABC (µg/m^3)
75-07-0	Acetaldehyde	0.45	140	470
67-64-1	Acetone		31,000	62,000
75-05-8	Acetonitrile		60	
107-02-8	Acrolein		0.35	6.9
7440-36-0	Antimony		0.3	1.0
107-13-1	Acrylonitrile	0.015	5	220
7440-38-2	Arsenic	0.00023	0.015	0.20
71-43-2	Benzene	0.13	3.0	29
100-44-7	Benzyl chloride	0.020	1.0	240
7440-41-7	Beryllium	0.00042	0.0070	0.020
75-25-2	Bromoform	0.91		

CASRN	Chemical Name	Chronic Cancer ABC (µg/m³)	Chronic Noncancer ABC (µg/m³)	Acute Noncancer ABC (µg/m³)
74-83-9	Bromomethane		5.0	3,900
106-99-0	1,3-Butadiene	0.033	2.0	660
78-93-3	2-Butanone		5,000	5,000
7440-43-9	Cadmium	0.00056	0.010	0.030
56-23-5	Carbon tetrachloride	0.17	100	1.900
108-90-7	Chlorobenzene		50	
75-00-3	Chloroethane		30,000	40,000
74-87-3	Chloromethane		90	1,000
126-99-8	2-Chloro-1,3-butadiene	0.0033	20	
18540-29-9	Hexavalent Chromium [Cr(VI)]	8.3E-05	0.20	0.30
67-66-3	Chloroform		300	490
7440-48-4	Cobalt		0.10	
110-82-7	Cyclohexane		6,000	
106-46-7	1,4-Dichlorobenzene	0.091	60	12,000
75-34-3	1,1-Dichloroethane	0.63		
156-60-5	trans-1,2-Dichloroethene			790
75-09-2	Methylene chloride	100	600	2,100
78-87-5	1,2-Dichloropropane		4.0	230
123-91-1	1,4-Dioxane	0.20	30	7,200
100-41-4	Ethylbenzene	0.40	260	22,000
106-93-4	1,2-Dibromoethane (EDB)	0.0017	9.0	
107-06-2	1,2-Dichloroethane (EDC)	0.038	7.0	
50-00-0	Formaldehyde	0.17	9.0	49
87-68-3	Hexachloro-1,3-butadiene	0.045		
110-54-3	n-Hexane		700	
67-63-0	Isopropanol		200	3,200
7439-92-1	Lead, Total		0.15	0.15
7439-96-5	Manganese, Total		0.090	0.30
108-10-1	4-Methyl-2-pentanone (MIBK)		3,000	
80-62-6	Methylmethacrylate		700	
1634-04-4	Methyl tert-butyl ether (MTBE)	3.8	8,000	8,000
91-20-3	Naphthalene	0.029	3.7	200
7440-02-0	Nickel	0.0038	0.014	0.2
56-55-3	Benzo(a)anthracene	0.0083		
50-32-8	Benzo(a)pyrene	0.0017	0.0020	0.0020
205-99-2	Benzo(b)fluoranthene	0.0021		
191-24-2	Benzo(g,h,i)perylene	0.19		
207-08-9	Benzo(k)fluoranthene	0.056		
218-01-9	Chrysene	0.017		
53-70-3	Dibenzo(a,h)anthracene	0.00017		
206-44-0	Fluoranthene	0.021		
193-39-5	Indeno(1,2,3-cd)pyrene	0.024		

CASRN	Chemical Name	Chronic Cancer ABC (μg/m^3)	Chronic Noncancer ABC (μg/m^3)	Acute Noncancer ABC (μg/m^3)
123-38-6	Propionaldehyde		8.0	
7782-49-2	Selenium, Total			2.0
100-42-5	Styrene		1,000	21,000
79-34-5	1,1,2,2-Tetrachloroethane	0.017		
127-18-4	Tetrachloroethylene	3.8	41	41
108-88-3	Toluene		5,000	7,500
71-55-6	1,1,1-Trichloroethane		5,000	11,000
79-00-5	1,1,2-Trichloroethane	0.063		
79-01-6	Trichloroethylene	0.24	2.1	2.1
95-63-6	1,2,4-Trimethylbenzene		60	
108-67-8	1,3,5-Trimethylbenzene		60	
75-01-4	Vinyl chloride	0.11	100	1,300
75-35-4	1,1-Dichloroethylene		200	200

8.2 Cumulative Excess Cancer and Noncancer Health Risks

State agencies evaluate cancer and noncancer health risks in different ways. A noncancer health effect is any kind of health effect other than cancer. Examples of noncancer health effects include (but are not limited to) respiratory problems, heart problems, or damage to the immune or nervous systems. For both cancer and noncancer health effects, DEQ divided the annual average measured air concentration of each pollutant by the chronic cancer and chronic noncancer ambient benchmark concentration (ABC) for that chemical (ABCs are introduced and shown for each chemical evaluated in table 7 in Chapter 5). DEQ then added those ratios separately for the noncancer ratios and for the cancer ratios.

Cancer risk from environmental exposure is considered in addition to the “background” risk of developing cancer over a lifetime. The American Cancer Society estimates that one in three women and one in two men will develop some type of cancer in their lifetime. These background cancers are from a combination of all reasons, which includes age, genetics, lifestyle factors like tobacco use, and environmental exposures. Cancer risk is expressed as a **probability** and can be thought of as the likelihood of additional cancer cases in a population. Table 8 expresses cancer risk as an estimated number of cancer cases per million people beyond the background cancer rate in society.

About 400,000 people per million will get cancer at some point in their lifetime. This is called the background rate of cancer. The cancer risk numbers in Table 8 represent excess cancer risk in a million from continuously breathing the air that DEQ evaluated at these different monitoring locations in addition to the background cancer rate of 400,000 in a million. Excess lifetime cancer risk less than 100 in a million is generally considered low compared to the background rate of 400,000 in a million. For more information about cancer risk, see this factsheet: https://www.oregon.gov/deq/aq/cao/Documents/CancerHealthRiskFactSheet.pdf.

Noncancer risk is expressed as a hazard index. A hazard index of 1 or less means that toxicologists do not expect that anyone would have any noncancer health effects related to breathing that air, even if they breathe it 24 hours a day, 7 days a week, for an entire lifetime. A hazard index above one does not necessarily mean that noncancer health effects are expected, but it does warrant a closer look. For more information about noncancer risk and hazard indices, see this factsheet: https://www.oregon.gov/deq/FilterDocs/caononcancerfs.pdf. Acrolein was the only contaminant that was above its chronic noncancer ABC at any monitoring site.

Not all sites are sampling for the full list of air toxics during certain periods. For example, the Bend 8th and Emerson, Portland Cully Helensview, and Eugene Amazon Park sites did not sample VOCs in 2022 due to challenges with sampling equipment. The health effects of these VOCs are not included in the cumulative risk for these sites.

Table 8: The excess cancer risk and hazard index for air toxics found at monitoring sites around the state of Oregon; * indicates the site is an annual rotating site with a sampling period including data outside of 2022.

Site Name	Cumulative Risk
Bend 8th & Emerson	
Cancer Risk (chances in a million)	19
Hazard Index	1
Corvallis Park & Goodnight*	
Cancer Risk (chances in a million)	22
Hazard Index	1
Eugene Amazon Park	
Cancer Risk (chances in a million)	10
Hazard Index	1
Eugene Hwy 99	
Cancer Risk (chances in a million)	36
Hazard Index	2
Hillsboro Hare Field	
Cancer Risk (chances in a million)	16
Hazard Index	1
La Grande Hall and N	
Cancer Risk (chances in a million)	41
Hazard Index	2
Medford Welch and Jackson	
Cancer Risk (chances in a million)	49
Hazard Index	2

Site Name	Cumulative Risk
Portland Cully Helensview	
Cancer Risk (chances in a million)	35
Hazard Index	2
Portland Humboldt School	
Cancer Risk (chances in a million)	29
Hazard Index	1
Tualatin Bradbury Court	
Cancer Risk (chances in a million)	18
Hazard Index	1

8.2.1 Annual Averages Compared to Chronic Cancer ABCs

In order to characterize which air toxics contribute to total cancer risk at each monitoring site, DEQ assessed the breakdown of risk by each individual contaminant. The following table compares the annual average at each site, for each pollutant, that is above its chronic cancer risk ABC. These data allow DEQ to flag specific pollutants at locations for prioritization and further consideration. The total cancer risks also include contributions from air toxics that were below their cancer ABCs. There are no corresponding tables for chronic noncancer risk because only one toxic air contaminant (acrolein) was above its chronic noncancer ABC.

Table 9[3]: Pollutants with annual average concentrations above their chronic cancer risk ABC. The "excess cancer risk", or the number of times over the ABC, is the probability of additional cancer cases in a population of a million. * indicates the site is an annual rotating site with a sampling period including data outside of 2022.

Site Name	Excess Cancer Risk (chances in a million)
Bend 8th & Emerson	
Acetaldehyde	3
Formaldehyde	11

[3] Table 9 rounds risk numbers to one significant digit to avoid implying a degree of precision that does not exist. The rounding was done after the addition of the all the ratios, so some totals do not appear to add up from the component parts.

Site Name	Excess Cancer Risk (chances in a million)
Bend 8th & Emerson	
Beryllium	1
Cadmium	1
Total cancer risk	**16**
Corvallis Park & Goodnight*	
Acetaldehyde	2
Arsenic	1
Benzene	3
1,3 Butadiene	1
Formaldehyde	9
Carbon Tetrachloride	3
1,2-Dichloroethane (EDC)	2
Total cancer risk	**22**
Eugene Amazon Park	
Acetaldehyde	2
Arsenic	2
Formaldehyde	6
Total cancer risk	**10**
Eugene Hwy 99	
1,3-Butadiene	3
Acetaldehyde	3
Arsenic	3
Benzene	6
Carbon tetrachloride	3
1,2-Dichloroethane (EDC)	2
Ethylbenzene	1
Formaldehyde	10
Naphthalene	3
Total cancer risk	**36**
Hillsboro Hare Field	
Acetaldehyde	2
Arsenic, Total	4
Formaldehyde	8
Naphthalene	1
Total cancer risk	**16**

Site Name	Excess Cancer Risk (chances in a million)
La Grande Hall and N	
1,3-Butadiene	1
1,2-Dichloroethane (EDC)	1
Acetaldehyde	6
Benzene	3
Carbon tetrachloride	3
Formaldehyde	24
Total cancer risk	**41**
Medford Welch and Jackson	
1,3-Butadiene	4
1,2-Dichloroethane (EDC)	2
Acetaldehyde	5
Acrolein	1
Arsenic	2
Benzene	8
Carbon tetrachloride	3
Ethylbenzene	1
Formaldehyde	20
Naphthalene	2
Total cancer risk	**49**
Portland Cully Helensview	
1,3-Butadiene	3
1,2-Dichloroethane (EDC)	2
Acetaldehyde	3
Arsenic	3
Benzene	6
Carbon tetrachloride	4
Formaldehyde	12
Naphthalene	1
Total cancer risk	**35**
Portland Humboldt School	
1,3-Butadiene	2
1,2-Dichloroethane (EDC)	2
Acetaldehyde	2
Arsenic	2
Benzene	5
Carbon tetrachloride	3

Site Name	Excess Cancer Risk (chances in a million)
Portland Humboldt School	
Formaldehyde	10
Naphthalene	1
Total cancer risk	**29**
Tualatin Bradbury Court	
Acetaldehyde	3
Arsenic	3
Formaldehyde	10
Naphthalene	2
Total cancer risk	**18**

Table 9 also demonstrates that several of the same pollutants were above their ABCs at most monitoring locations, indicating that the presence of these pollutants is widespread and not unique to individual communities. Examples include acetaldehyde, arsenic, benzene, formaldehyde, and naphthalene. More information about the health effects of these pollutants can be found at EPA's Health Effects Notebook for Hazardous Air Pollutants.

Formaldehyde is the pollutant commonly found to be the largest contributor to chronic cancer risk when compared to its ABC. Naturally occurring sources of formaldehyde include trees, fruits and vegetables, and even humans. Non-naturally occurring sources include manufacturing of composite wood products, car exhaust and household products. More information about formaldehyde, its risks, and sources can be found at the EPA website, Facts About Formaldehyde.

9. Data Summary

9.1 Data Completeness

Data completeness is a measure of how much data is missing in a dataset. Oregon DEQ estimated data completeness as the number of valid samples divided by the number of expected samples for a given time. The minimum quality objective for the Air Toxics Monitoring program is to achieve a data completeness of greater than or equal to 85% for a given quarter. Completeness was calculated for each sample type by using the number of valid samples from a single analyte to represent the number of valid samples for the entire analyte group. The representative analytes were chosen because they are rarely voided during sample analysis.

Complete datasets of evenly distributed air samples throughout the year are ideal to remove bias from seasonality and to calculate annual average concentrations that are representative over the entire year. However, this is not always possible due to sampling issues and available resources.

The Eugene Amazon Park site stopped sampling in June 2022 and data after that date is not available. The results of the shortened sampling period in 2022 are included in this report. Sampling data for previous years is available in the [Air Toxics Summaries for 2019-2021 Report](). The other annual rotating site, Corvallis Park & Goodnight, is also an exception. Sampling began in April of 2021 and was paused in March of 2022. Due to a number of voided samples, monitoring began again in July of 2022 and lasted until December 2022. After this, monitoring began again for VOCs only in April of 2023 and finally ended in July of 2023. This decision was made to complete a dataset that was comparable to a full year's worth of data. The full dataset for all sampling at Corvallis Park & Goodnight was analyzed in this report.

DEQ discontinued sampling for hexavalent chromium at several sites in February 2022. Most sample results indicated chromium concentrations below the limits of detection.

Due to robust quality assurance plans and standard operating procedures that exist for field and laboratory methods, samples may be voided at various stages of the sample collection and analysis process. Common reasons for a sample to be voided include, but are not limited to: power failures at the monitoring site, sampling instrument malfunction, issues with sample extraction in the laboratory, or laboratory instrument performance criteria not being met during analysis. When a sample is voided during the sample collection process, it is standard operating procedure to collect a make-up sample as soon as possible; make-up samples may occur several days or weeks after the original sample failed. For this reason, completeness is reported for the year to evaluate the sampling effort over the course of the year. In addition to individual voided samples, instruments malfunction and samples can't be collected until the sampler is repaired. This may lead to several missed sample dates in the sampling calendar.

Table 10: Data completeness for each sample type at each site relative to the initial start date. – indicates that sampling for that sample type was not scheduled to occur.

Year	*Project*	*Sample Type*	*Start Date*	*End Date*	*# of Samples*	*Expected Samples*	*% Completeness*
2022	Bend 8th & Emerson	Carbonyls	1/5/2021	12/31/2022	56	61	92%
2022	Bend 8th & Emerson	Metals	1/5/2021	12/31/2022	58	61	95%
2022	Bend 8th & Emerson	Cr6+	--	--	--	--	--
2022	Bend 8th & Emerson	PAHs	1/5/2021	12/31/2022	59	61	97%
2022	Bend 8th & Emerson	VOCs	--	--	--	--	--
2022	Medford Welch and Jackson	Carbonyls	1/5/2022	12/31/2022	50	61	82%
2022	Medford Welch and Jackson	Metals	1/5/2022	12/31/2022	60	61	98%
2022	Medford Welch and Jackson	Cr6+	1/5/2022	12/31/2022	60	61	98%
2022	Medford Welch and Jackson	PAHs	1/5/2022	12/31/2022	55	61	90%
2022	Medford Welch and Jackson	VOCs	1/5/2022	12/31/2022	54	61	88%
2022	Eugene Hwy 99	Carbonyls	1/5/2022	12/31/2022	55	61	90%
2022	Eugene Hwy 99	Metals	1/5/2022	12/31/2022	61	61	100%
2022	Eugene Hwy 99	Cr6+	1/5/2022	12/31/2022	61	61	100%
2022	Eugene Hwy 99	PAHs	1/5/2022	12/31/2022	55	61	90%

Year	*Project*	*Sample Type*	*Start Date*	*End Date*	*# of Samples*	*Expected Samples*	*% Completeness*
2022	Eugene Hwy 99	VOCs	1/5/2022	12/31/2022	56	61	84%
2022	Eugene Amazon Park (ended June 22	Carbonyls	1/5/2022	6/22/2022	25	29	86%
2022	Eugene Amazon Park	Metals	1/5/2022	6/22/2022	29	29	100%
2022	Eugene Amazon Park	Cr6+	--	--	--	--	--
2022	Eugene Amazon Park	PAHs	1/5/2022	6/22/2022	29	29	100%
2022	Eugene Amazon Park	VOCs	--	--	--	--	--
2022	Portland Humboldt School	Carbonyls	1/5/2022	12/31/2022	56	61	92%
2022	Portland Humboldt School	Metals	1/5/2022	12/31/2022	62	61	100%
2022	Portland Humboldt School	Cr6+	1/5/2022	12/31/2022	59	61	97%
2022	Portland Humboldt School	PAHs	1/5/2022	12/31/2022	61	61	100%
2022	Portland Humboldt School	VOCs	1/5/2022	12/31/2022	55	61	90%
2022	Portland Cully Helensview	Carbonyls	1/5/2022	12/31/2022	53	61	87%
2022	Portland Cully Helensview	Metals	1/5/2022	12/31/2022	52	61	85%
2022	Portland Cully Helensview	Cr6+	1/5/2022	12/31/2022	53	61	87%
2022	Portland Cully Helensview	PAHs	1/5/2022	12/31/2022	60	61	93%
2022	Portland Cully Helensview	VOCs	--	--	--	--	--
2022	La Grande Hall and N	Carbonyls	1/5/2022	12/31/2022	39	61	64%
2022	La Grande Hall and N	Metals	1/5/2022	12/31/2022	56	61	92%
2022	La Grande Hall and N	Cr6+	--	--	--	--	--
2022	La Grande Hall and N	PAHs	1/5/2022	12/31/2022	52	61	85%
2022	La Grande Hall and N	VOCs	1/5/2022	12/31/2022	51	61	84%
2022	Hillsboro Hare Field	Carbonyls	1/5/2022	12/31/2022	58	61	95%
2022	Hillsboro Hare Field	Metals	1/5/2022	12/31/2022	60	61	98%
2022	Hillsboro Hare Field	Cr6+	--	--	--	--	--
2022	Hillsboro Hare Field	PAHs	1/5/2022	12/31/2022	60	61	98%
2022	Hillsboro Hare Field	VOCs	--	--	--	--	--
2022	Tualatin Bradbury Court	Carbonyls	1/5/2022	12/31/2022	60	61	98%
2022	Tualatin Bradbury Court	Metals	1/5/2022	12/31/2022	60	61	98%
2022	Tualatin Bradbury Court	Cr6+	--	--	--	--	--
2022	Tualatin Bradbury Court	PAHs	1/5/2022	12/31/2022	59	61	98%
2022	Tualatin Bradbury Court	VOCs	--	--	--	--	--
2022	Corvallis Park & Goodnight	Carbonyls	4/22/2021	12/1/2022	55	N/A	N/A

Year	Project	Sample Type	Start Date	End Date	# of Samples	Expected Samples	% Completeness
2022	Corvallis Park & Goodnight	Metals	4/22/2021	12/1/2022	57	N/A	N/A
2022	Corvallis Park & Goodnight	Cr6+	4/28/2021	12/1/2022	69	N/A	N/A
2022	Corvallis Park & Goodnight	PAHs	4/22/2021	12/1/2022	52	N/A	N/A
2022	Corvallis Park & Goodnight	VOCs	4/22/2021	7/11/2023	57	N/A	N/A

9.2 Air Toxics Comparisons and Regional Highlights

9.2.1 National Averages

To provide context about the levels of these pollutants, we compared them to pollutants at other air toxics monitoring sites around the US. As Table 10 indicates, several of the same pollutants are present at most sites around the state. The following table uses the annual averages of air toxics monitoring sites around the US in 2021 (because 2022 data was not available) and compares them to the chronic cancer risk ABC for that pollutant. This dataset uses approximately 91 sites in 66 cities of various sizes across the continental US. Data about monitoring sites outside of Oregon are provided by the EPA.

Table 11: "Excess Cancer Risk" for US averages. This list provides context to the pollutants we commonly see above their chronic cancer risk ABC at sites in Oregon.

Air Toxic	Excess Cancer Risk
1,3-Butadiene	4
Acetaldehyde	4
Acrolein	2
Arsenic	4
Benzene	5
Carbon tetrachloride	3
Ethylbenzene	1
Formaldehyde	17
Naphthalene	7

[4]

[4] *Cancer risk values are rounded to 1 significant digit.*

9.3 KPM Trends at National Air Toxics Trends Sites

The Portland and La Grande National Air Toxics Trends Sites (NATTS) sites serve as long-term urban and rural air quality monitoring sites. Annual averages for the last six years were calculated for the five KPM analytes at both NATTS sites (Figures 24-28, 30-34). For further context, long-term trends beginning in 2004 for key performance measure pollutants are displayed in a combined chart (Figures 29, 35). In many figures the air toxic's ambient benchmark concentration is shown for reference.

Figures 24-28. Six-year trends for KPM analytes at the Portland NATTS site. The chronic cancer risk ambient benchmark concentration (ABC) is shown for reference.

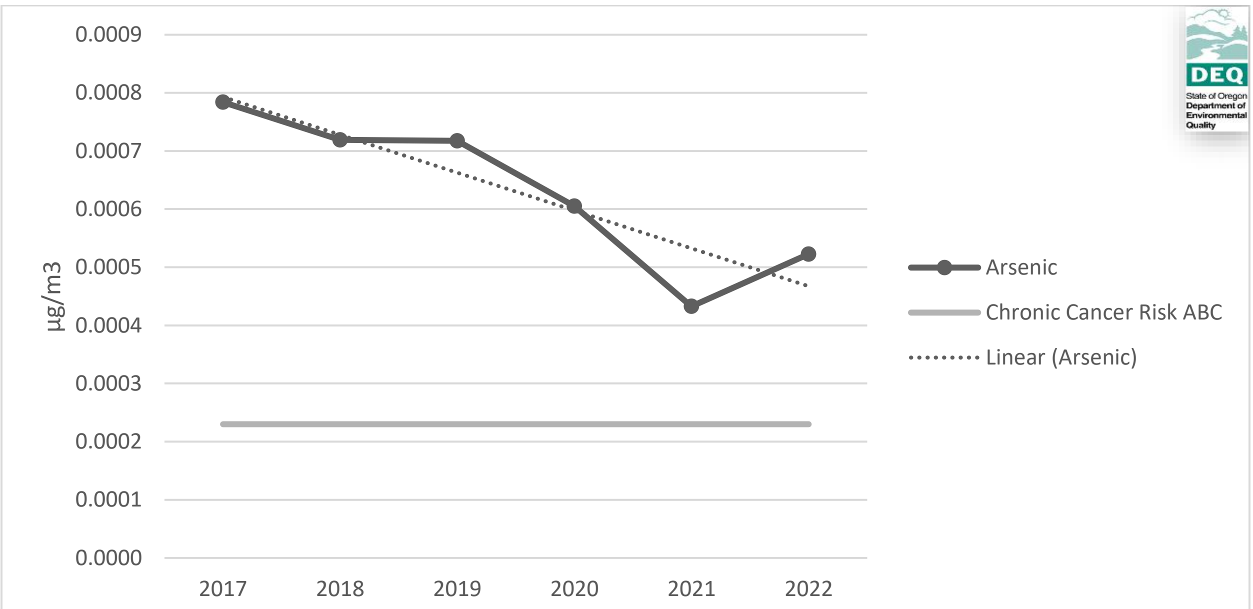

Figure 22: Arsenic trend at Portland NATTS site. Despite a downward trend, annual averages remain above the ABC for chronic cancer risk.

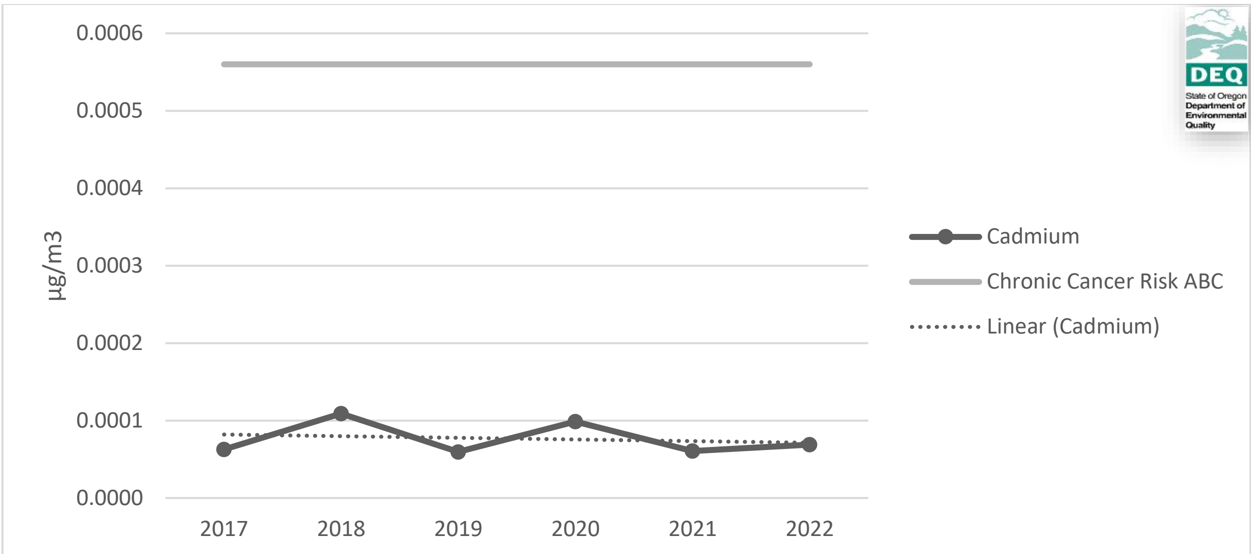

Figure 23: Cadmium trend at Portland NATTS site. Cadmium levels remain relatively unchanged and are below chronic cancer risk levels.

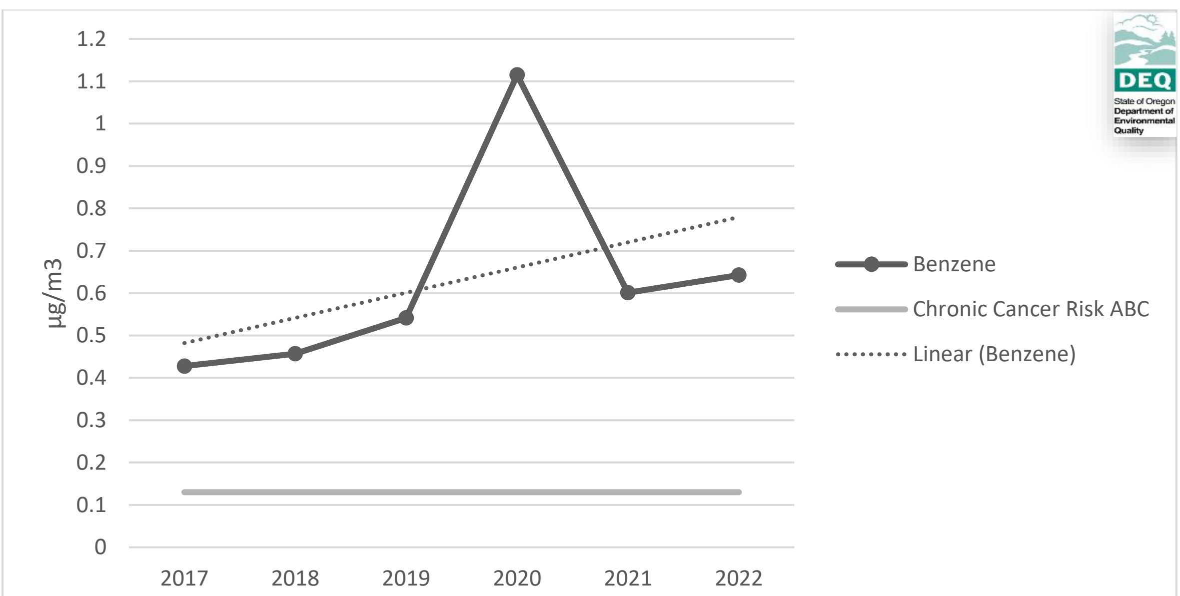

Figure 24: Benzene trend at Portland NATTS site. A spike in benzene levels in 2020 is biased by wildfire smoke.

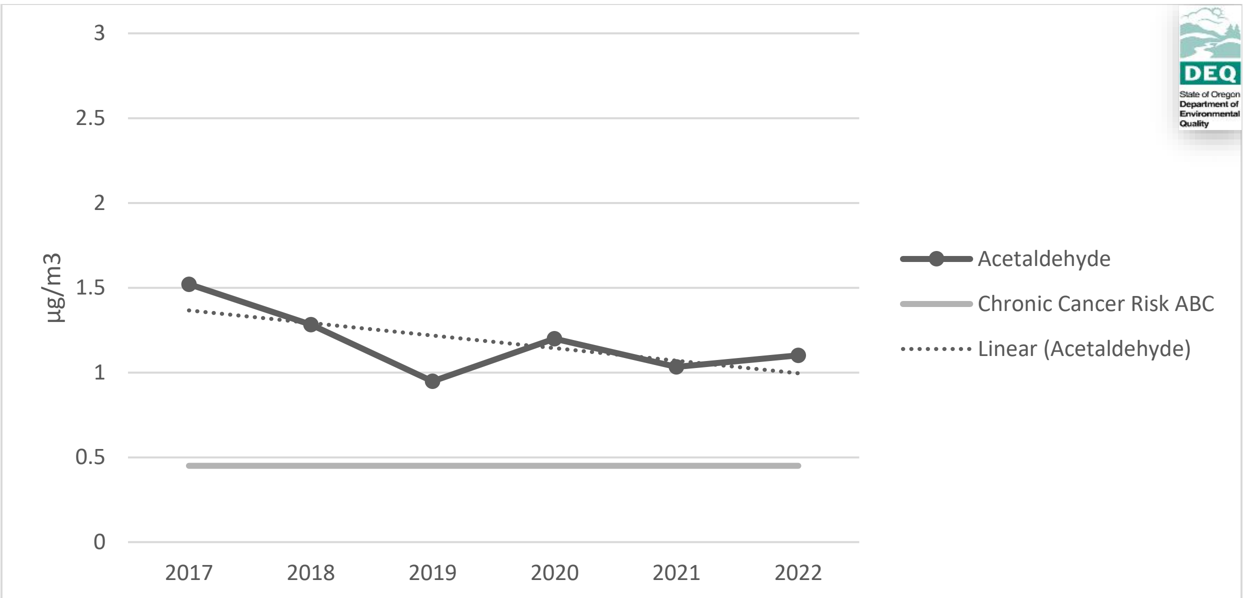

Figure 25: Acetaldehyde trend at Portland NATTS site. Despite a downward trend, levels remain above chronic cancer risk ABC.

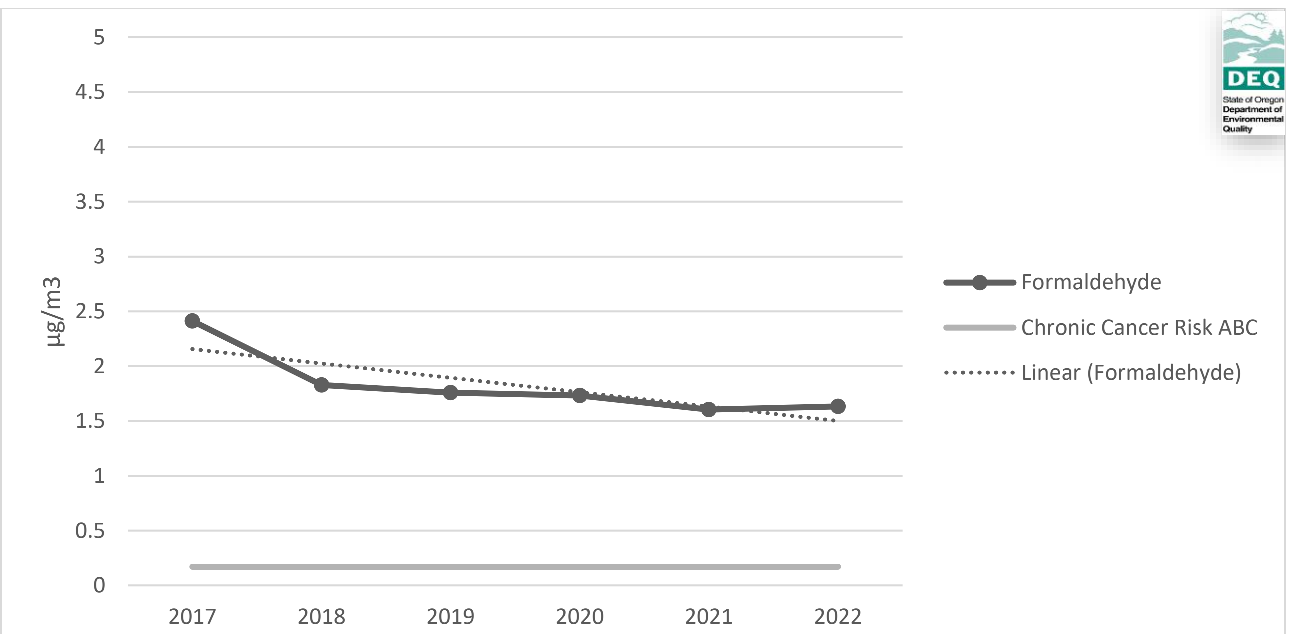

Figure 26: Formaldehyde trend at Portland NATTS site. Pollutant levels trend downward but remain above chronic cancer risk ABC.

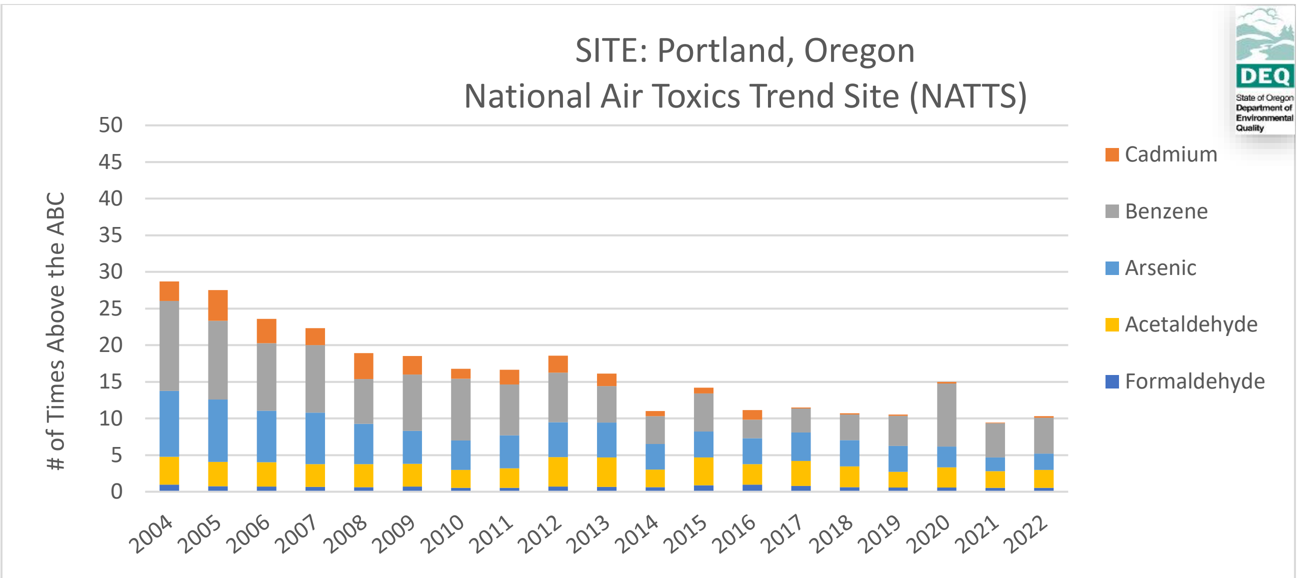

Figure 27: Long term trends for KPMs at Portland NATTS site.

Figures 30-34. Five-year trends for KPM analytes at the La Grande NATTS site. The chronic cancer risk ambient benchmark concentration (ABC) is shown for reference.

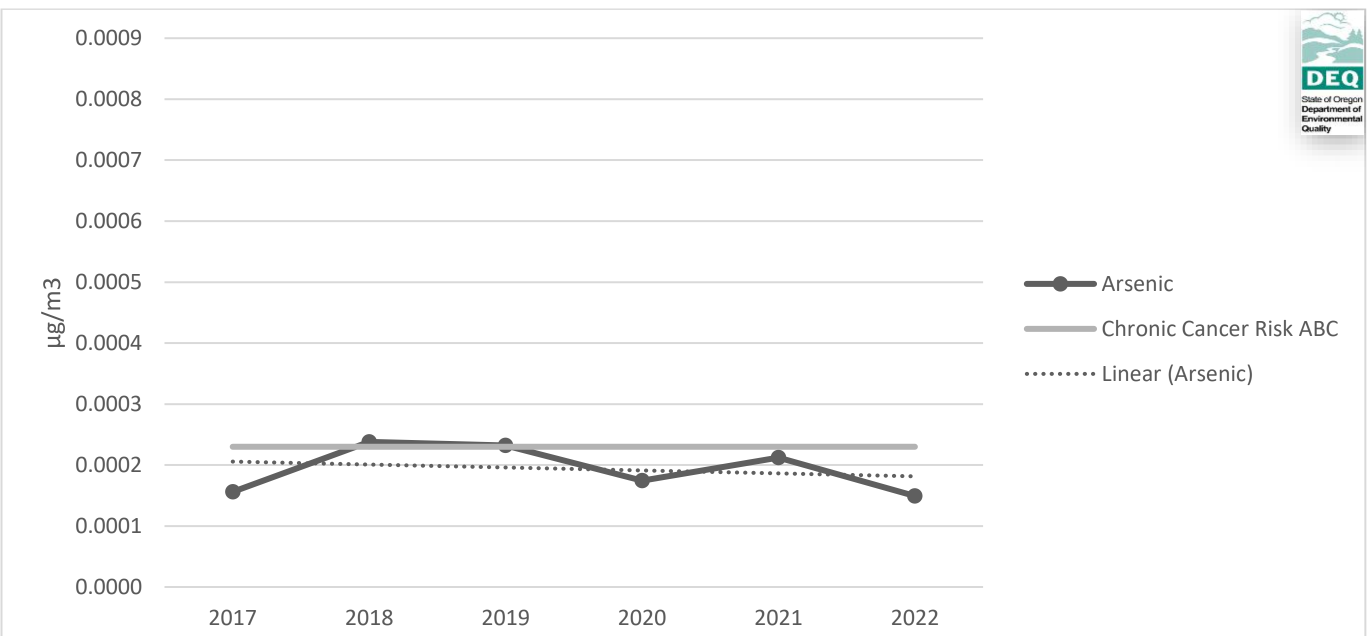

Figure 28: Arsenic trend at La Grande NATTS site. Levels have remained relatively unchanged.

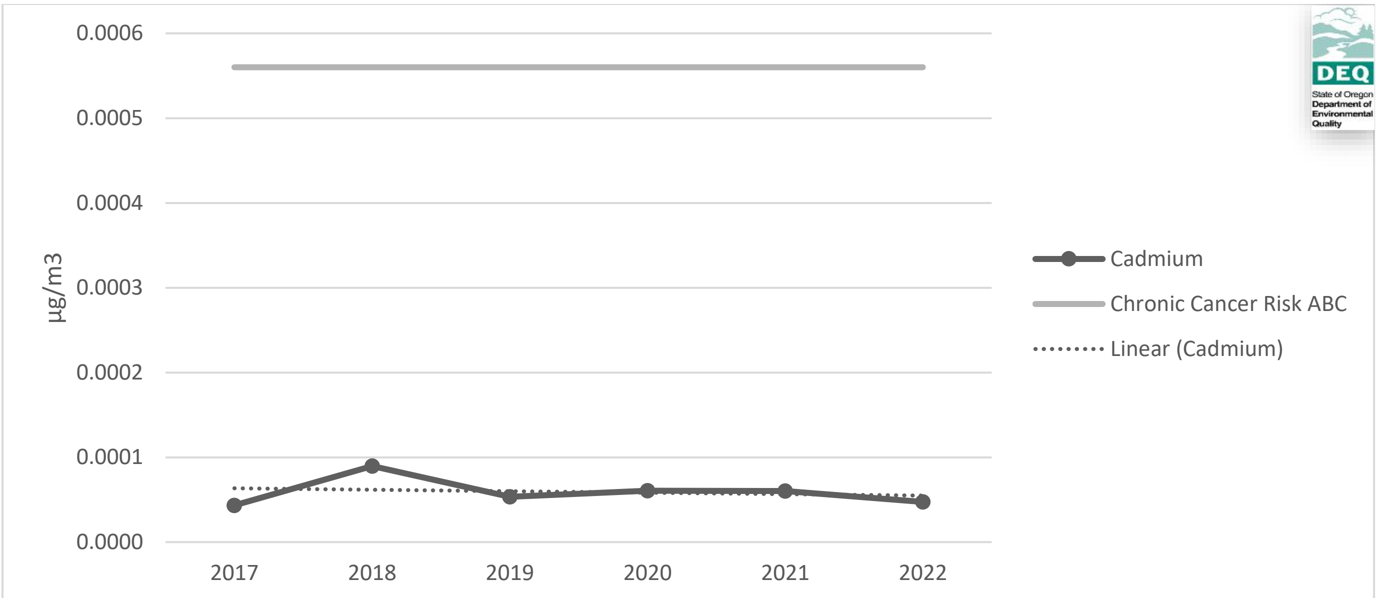

Figure 29: Cadmium trend at La Grande NATTS site. Similar to the Portland NATTS site, levels remain below their chronic cancer risk ABC.

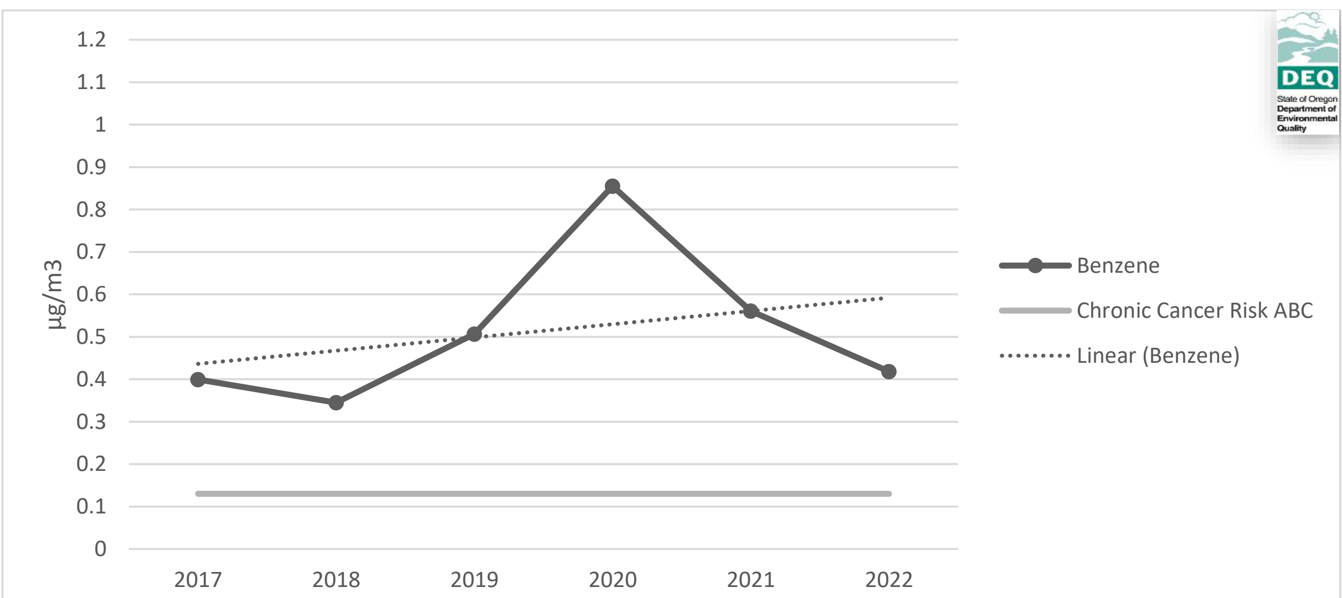

Figure 30: Benzene trend at La Grande NATTS site. Chronic cancer risk ABC shown for reference.

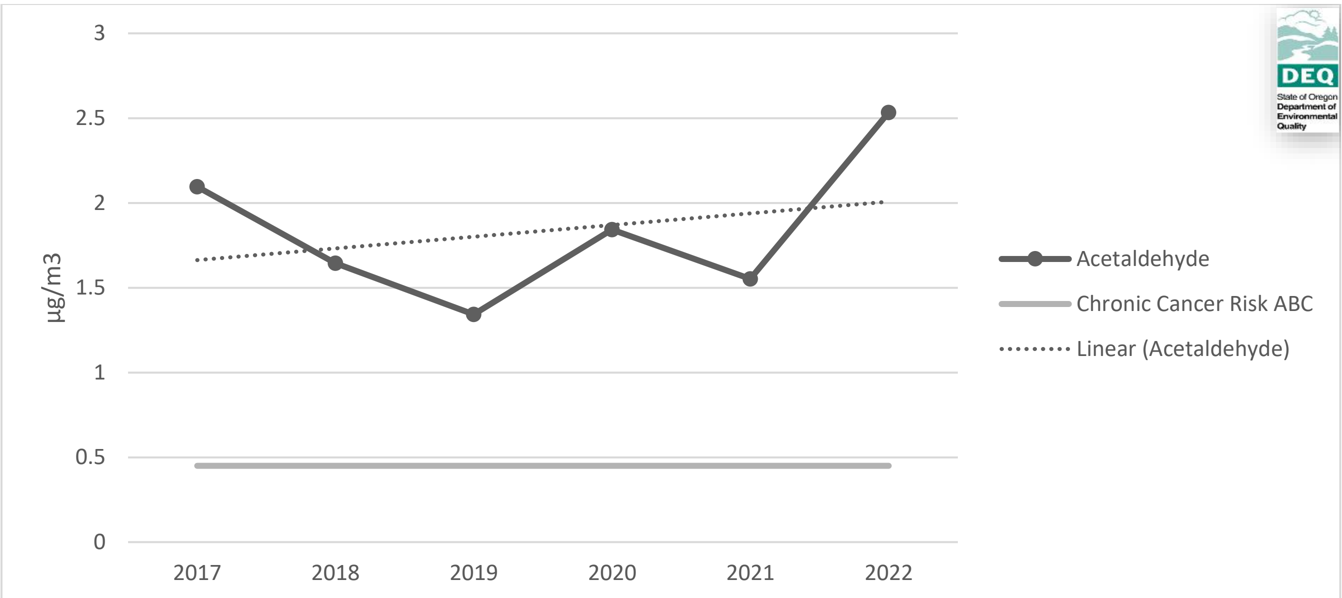

Figure 31: Acetaldehyde trend at La Grande NATTS site. Levels show an upward trend for the last six years and remain above their chronic cancer risk ABC.

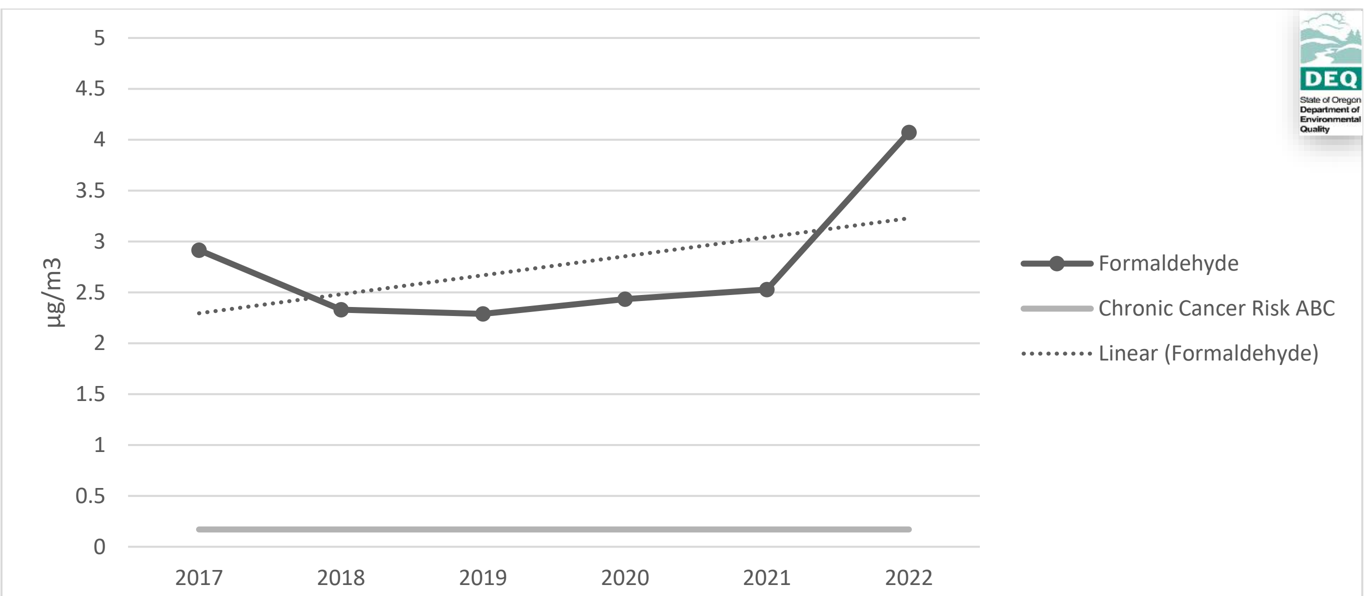

Figure 32: Formaldehyde trend at La Grande NATTS site.

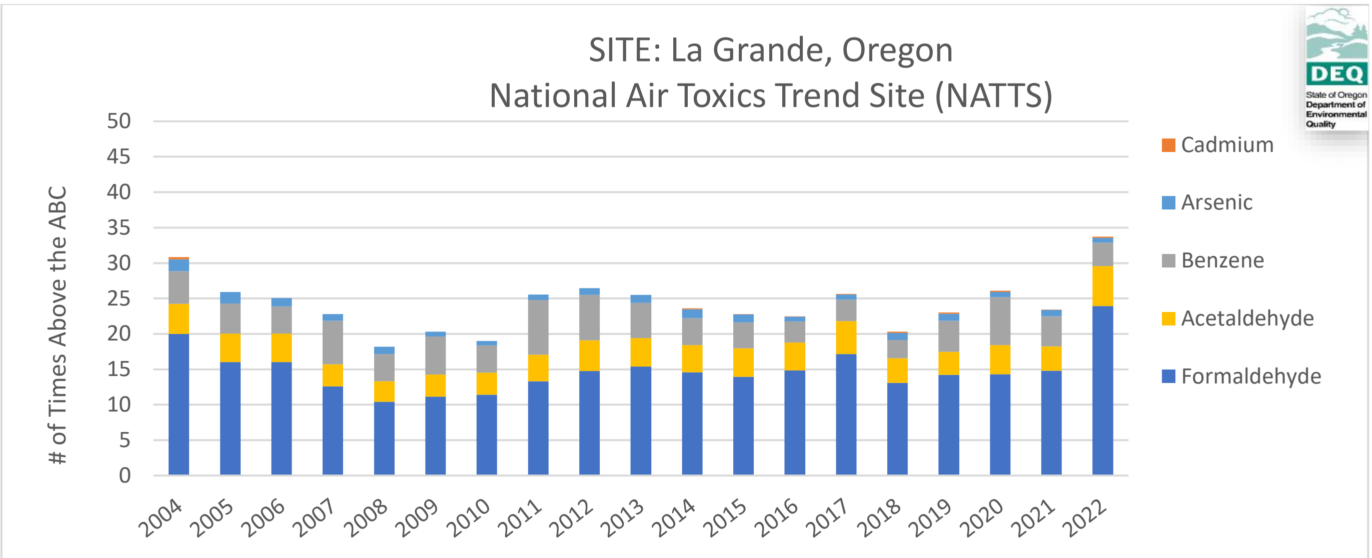

Figure 33: Long term KPM trends at La Grande NATTS site.

10. Future Monitoring

At the time of this report, DEQ operates 11 air toxics monitoring sites. This air toxics monitoring network may expand or decrease monitoring depending on where and when high-quality data is needed. NATTS sites will continue to produce data for long-term monitoring and evaluation with rotating annual sites being prioritized and moved as necessary. Monitoring equipment will continue to be updated, evaluated, tested, and deployed in the field when and where available. DEQ's air toxics monitoring program and laboratory analytical methods will continue to evolve and be updated based on guidance from EPA and best available scientific methods.

In August 2023, DEQ updated its procedures to be compliant with the NATTS technical assistance document revision 4. This document provides updated guidance on how to monitor for the NATTS program. It includes updates to monitoring guidelines and analytical methods used to analyze samples.

In addition to gathering high quality data, DEQ is striving to make monitoring data more easily accessible online and in other formats. As the air toxics monitoring network continues to evolve, DEQ will continue to provide high-quality data to inform Oregonians about the levels of air toxics in their communities.